



A New NACP Data Set: Woody Vegetation Characteristics of 1,039 Sites across the North Slope, Alaska



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A data set “Woody Vegetation Characteristics of 1,039 Sites across the North Slope, Alaska” (<http://dx.doi.org/10.3334/ORNDAAC/1270>) was developed for the North American Carbon Program (NACP). It contains statistics on shrub canopies (shrubs > 0.5 m in height) in 250 × 250 m sites across the North Slope of Alaska, ca 2010. It provides the results of (1) field measurements of woody vegetation (shrubs) at 26 diverse sites across the North Slope of Alaska during 2010 and 2011, (2) field-based statistical estimates of site shrub structural characteristics, (3) high-resolution panchromatic satellite imagery-based estimates of the field site shrub characteristics using the Canopy Analysis with Panchromatic Imagery (CANAPI) approach, and (4) adjusted CANAPI estimates of shrub characteristics at 1,013 selected sites widely distributed across the North Slope. The data set was constructed in several stages: aerial survey; field inventory; interpretation of high resolution QuickBird and GeoEye panchromatic imagery made available by the National Geospatial-Intelligence Agency (NGA) Commercial Archive Data site (<http://cad4nasa.gsfc.nasa.gov>); and collation of results. The two field campaigns on the North Slope took place during 24 July - 12 August 2010 and 20 July - 9 August 2011, at the peak of the growing season. The 2010 campaign included sites accessible via the Chandler and Colville Rivers, from the Brooks Range to the Arctic Coastal Plain, while the 2011 campaign surveyed 12 sites along the Dalton Highway from the Brooks Range to the Arctic Coast. This data set should prove useful to researchers in NASA's upcoming Arctic-Boreal Vulnerability Experiment (ABOVE; Kasischke et al. 2010) who need access to validation data for assessing medium (10-30 m) and moderate resolution (>250 m) Earth Observation products.

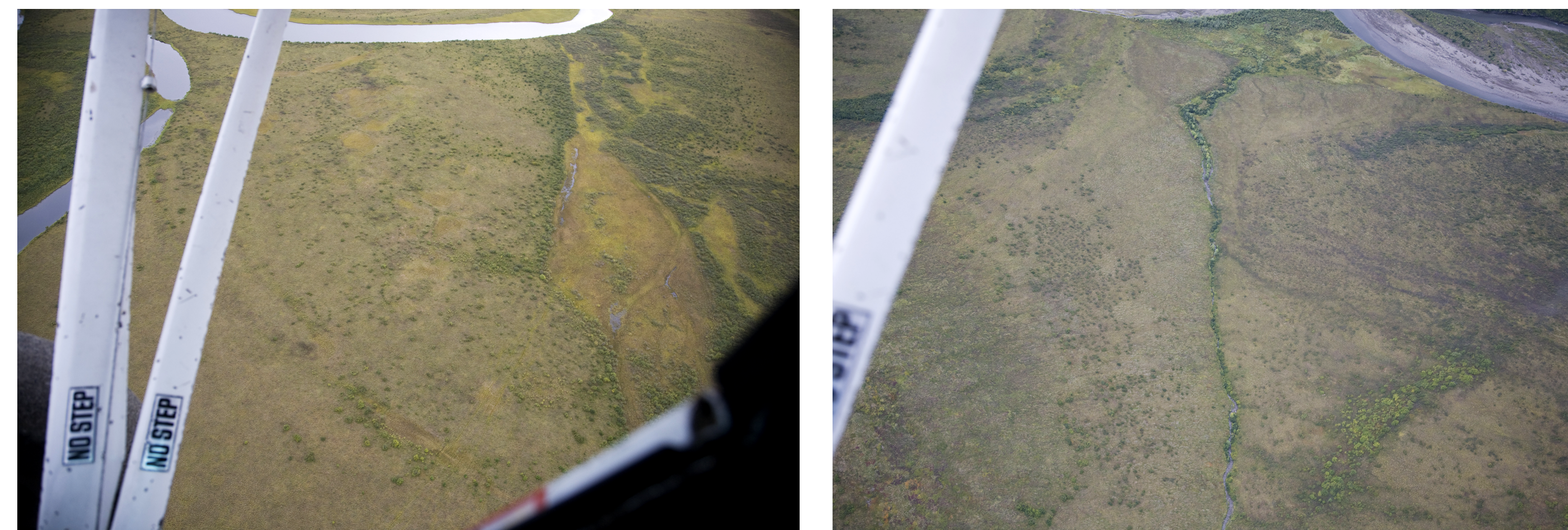


Figure 1. Sites were selected along the Chandler River based on aerial survey in August 2009. Photography: Ken Tape.

A belt transect method was used in all surveys, with transects of 5 m wide and 250 m long. The number of transects per site varied between 5 or 10 depending on the difficulty of access to the area (Figure 2). The geographic location was recorded and a photographic record of each surveyed shrub was taken and used to estimate width (horizontal extent) and height (vertical extent from base to top of foliage; see images at top left & top right). These field data are considered to be reliable because each shrub was physically measured *in situ*. These estimates allowed the determination of fractional cover, mean crown radius, and mean shrub height for each 250 × 250 m site (Figure 3). Further details are given in Duchesne et al. 2015 (a,b).

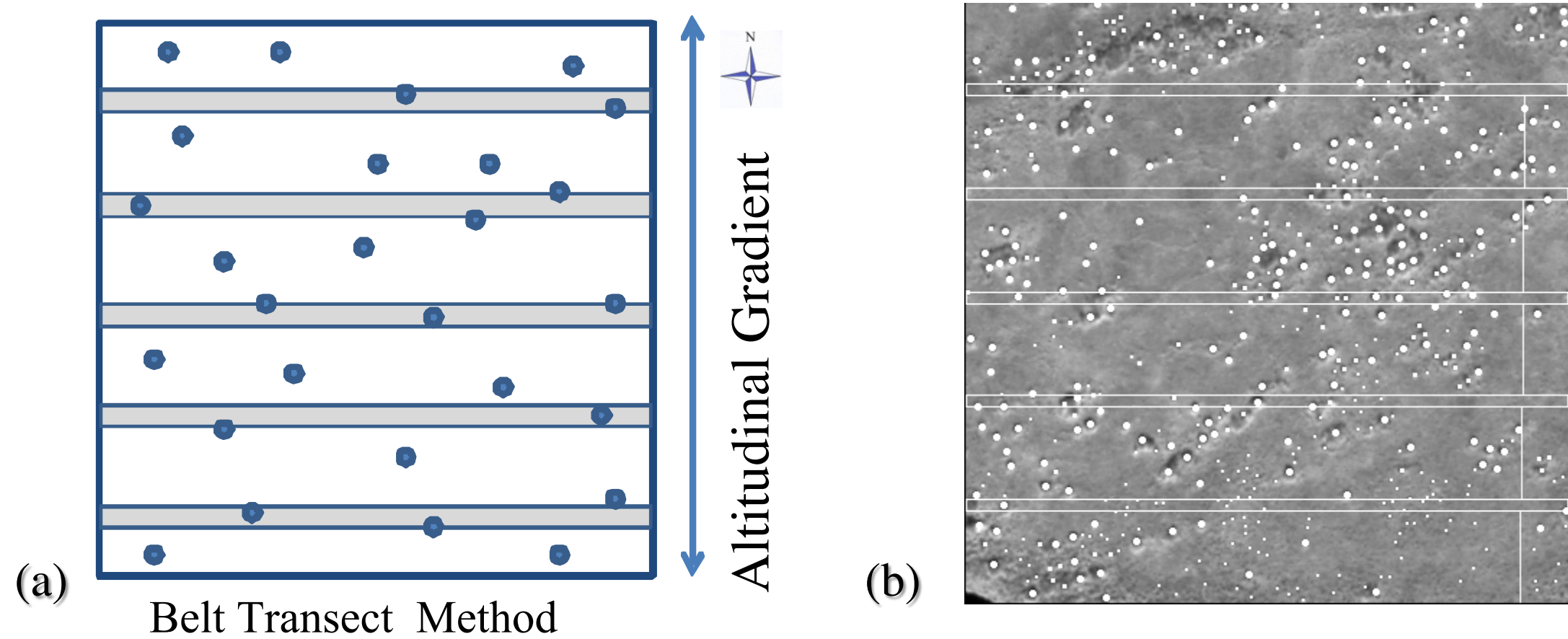


Figure 2. (a) Schematic of field survey protocol for sites of 250 m x 250 m. Five or ten 5 m belt transects were used to survey shrubs with heights > 0.5 m at each site. (b) QuickBird panchromatic subset for the Colville-02 site (white dot = shrub).

The Canopy Analysis using Panchromatic Imagery (CANAPI) algorithm (Chopping 2011) was used to map shrubs in high resolution imagery from DigitalGlobe Inc. QuickBird and GeoEye imagers for additional sites (Figs 4 & 5).

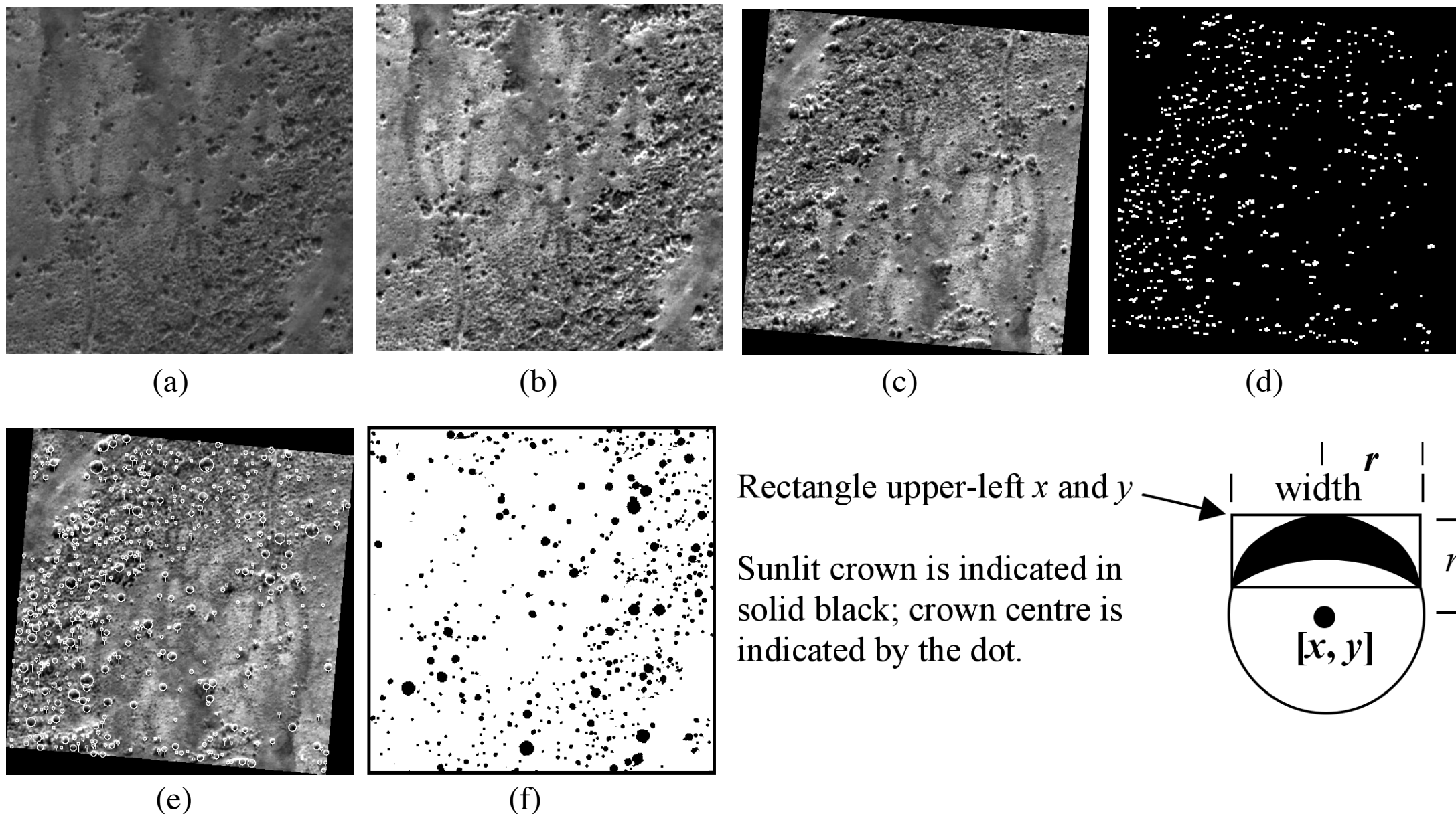
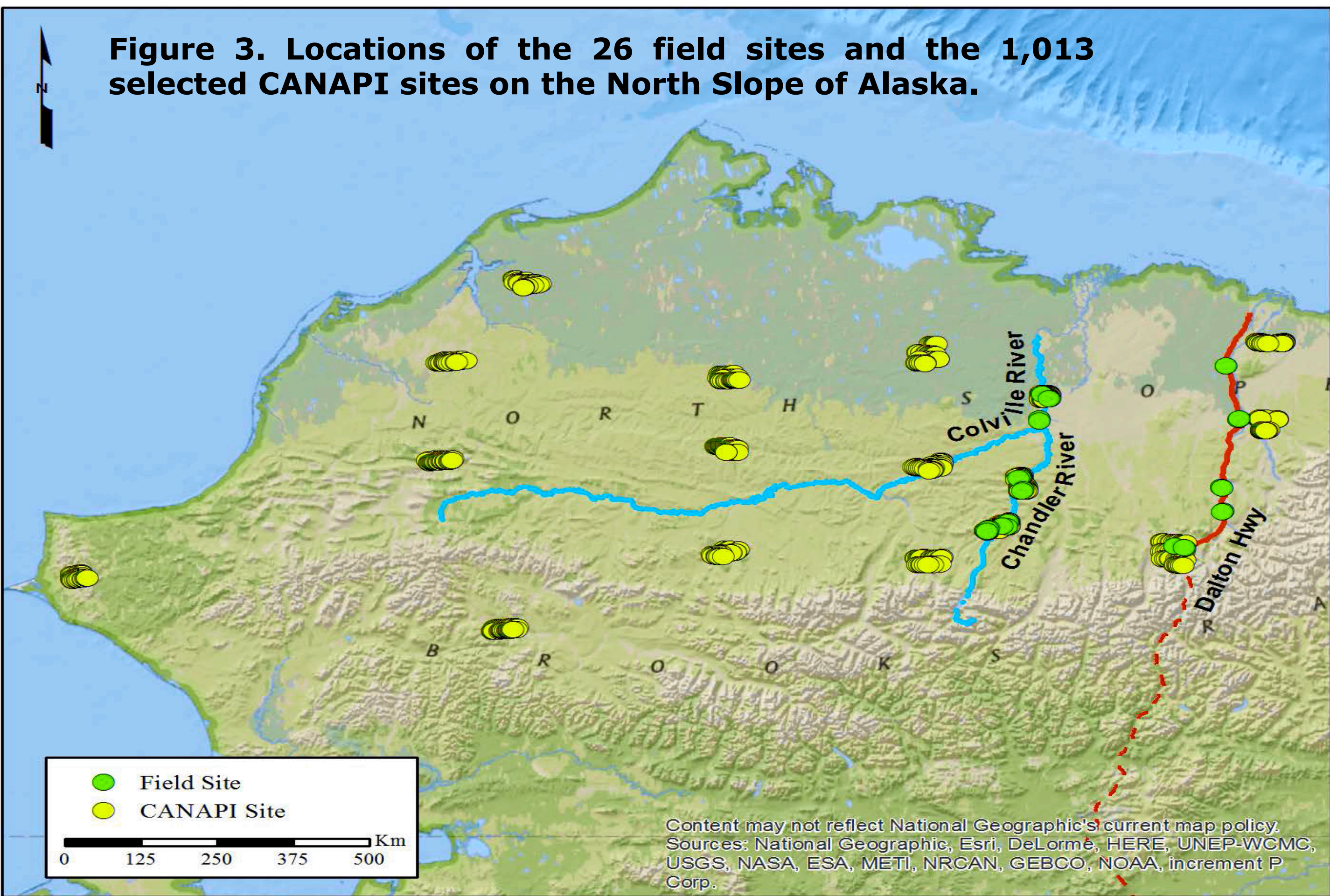


Figure 4. Operation of the Canopy Analysis using Panchromatic Imagery (CANAPI) algorithm over a 250 m x 250 m site: (a) original 16-bit QuickBird 0.6 m pan image (b) contrast-enhanced (c) rotated so that the solar direction is up (d) sunlit crown map after thresholding, convolution filtering, binary open and watershed operations (e) with detected crowns and (circles) and shadows (lines) (f) crown map (g) schematic indicating how CANAPI estimates crown center location and radius.

TABLE 1. DESCRIPTION OF THE FIELD SITES					
Site Name	Center Pixel Coordinate		Elevation	Date	Dominant
	(Albers Projection ¹ , m)		a.m.s.l.	Sampled	Vegetation
	X	Y	(m)	(d.m.y)	Type
Colville-01	98250	2190000	94	11.08.2010	Graminoid
Colville-02	102500	2187250	96	10.08.2010	Wetland
Colville-03	97750	2172250	96	09.08.2010	Erect-shrub
Colville-04	97750	2171000	96	09.08.2010	Erect-shrub
Colville-05	87750	2128750	150	05.08.2010	Graminoid
Colville-06	86750	2128250	145	05.05.2010	Graminoid
Colville-07	89750	2120000	143	03.08.2010	Graminoid
Colville-08	89500	2119000	222	03.08.2010	Graminoid
Colville-09	81500	2095500	249	08/02/2010	Graminoid
Colville-10	81000	2092000	249	08/01/2010	Graminoid
Colville-11	78000	2092500	297	30.07.2010	Graminoid
Colville-12	70000	2090500	287	29.07.2010	Graminoid
Colville-13	69750	2090000	289	28.07.2010	Graminoid
Colville-14	69250	2088250	290	29.07.2010	Graminoid
Dalton-01	203500	2216750	80	30.07.2011	Wetland
Dalton-02	203250	2216500	78	30.07.2011	Wetland
Dalton-03	213750	2178750	203	29.07.2011	Graminoid

¹ Coordinates are for an instance of the Albers Conical Equal Area map projection; see Duchesne et al, 2015(a,b) for details and the map projection parameters used.

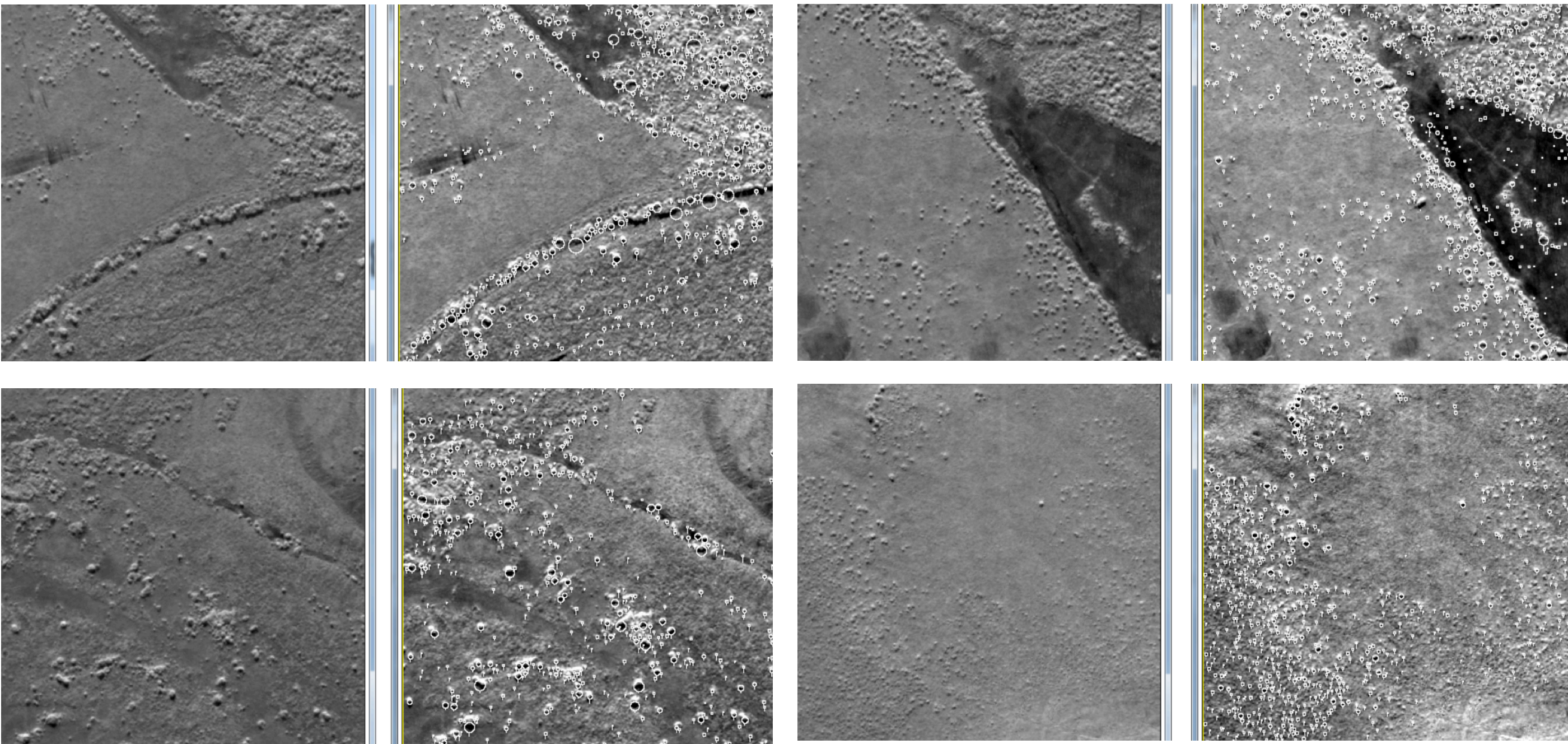


Figure 5. Examples of QuickBird panchromatic subsets (L) with shrub crowns detected by the CANAPI algorithm (R). Each site is 250 m x 250 m.

The data set was expanded using CANAPI for sites that are geographically distant and ecologically distinct with panchromatic images from the NASA NGA/CDA that provides access to large volumes of high resolution imagery for NASA Earth Science investigators. The additional 250 × 250 m sites were selected from 20 panchromatic QuickBird and GeoEye scenes and were chosen to include locations within four broad physiognomic categories and across the broad latitudinal and longitudinal range of the North Slope of Alaska (Figure 3).

Site estimates of fractional shrub cover, mean crown radius, total number of shrubs, and mean shrub height from CANAPI were adjusted with respect to the *in situ* measurements (Figure 6 and Duchesne et al. 2015(a,b)). The data set's shrub cover estimates can be used as reference data to assess other remote-sensing based estimates, for example, the Landsat-based all and tall (> 1 m) shrub cover maps published by Beck et al. (2011) and those from modeling and empirical approaches with MISR (geometric-optical model inversion; BRDF model kernel weights as indicators of canopy structure); Figure 7.

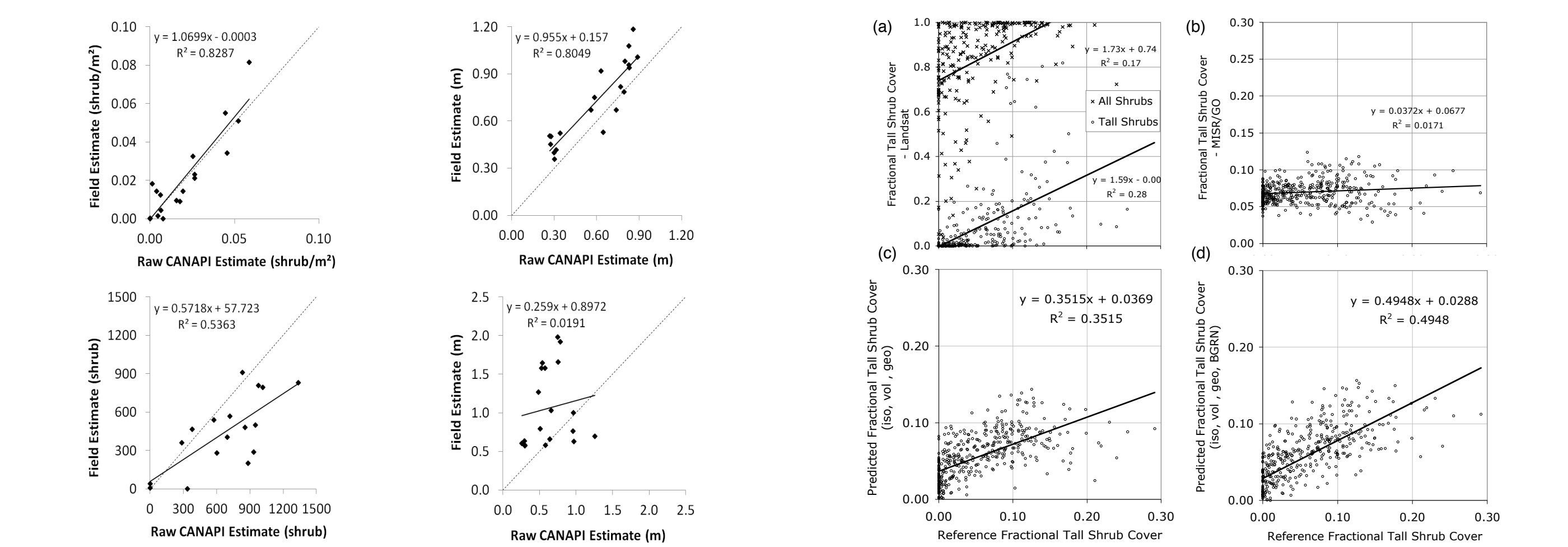


Figure 6. Relationships between raw CANAPI estimates and field estimates for field sites. (a) fractional cover (b) mean crown radius (c) total number of shrubs (d) mean height.

Figure 7. Shrub cover from remote sensing versus reference data (a) Landsat (b) MISR/GO (c) MISR RTLS-R kernel weight Z scores (d) MISR RTLS-R kernel weight Z scores plus nadir BRFs.

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Acknowledgments: This work was supported by NASA Terrestrial Ecology Award NNX09AL03G to M.C. and a Geological Society of America Graduate Student Research grant to R.R.D.. Thanks are also owed to field assistants Jesse Carlstrom, Michael Cohrs, and Scott Buchanan. **Data Credits:** We thank DigitalGlobe, Inc., Jaime Nickerson (NASA/GSFC) and the NASA Commercial Data Access (CDA) / National Geospatial-Intelligence Agency (NGA) for providing high-resolution imagery (<http://cad4nasa.gsfc.nasa.gov>). More information, maps, data, and code: <http://csam.montclair.edu/~chopping/tundra>